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NASA CR-115105

FINAL REPORT

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Testing of Apollo Black and White
Television Cameras

NAS 9-10997

WEC 57660

Westinghouse Electric Corporation
Aerospace and Electronic Systems Division
Baltimore, Maryland



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In accordance with contract NAS9-10997, the black & white Lunar TV Cameras (P.N 607R962, Serial #P0006, 0010, 0013) were tested per WEC T-Spec 854152 and the following performance characteristics evaluated:

1. S/N as a function of light level and frame rate.
2. Resolution as a function of light level and frame rate.
3. Shades of Grey.
4. Linearity.
5. Shading.

In addition, the cameras were examined for blemishes, extraneous noise and the condition of tube potting.

Included in this report is a copy of the test specification (T854152) indicating the measurements and procedures for the tests, test record sheets Westinghouse form 2509E, and photographs as well as the actual test data for the three cameras tested.

The data recorded as part of this series of tests have been compared to the acceptance test data for these cameras at the time of manufacture. The comparison of these two sets of data indicate that the cameras' performance has not degraded due to five years storage from time of manufacture.

Total lifetime of a camera may be predicted based on the extent of degradation measured over a period of time. Since no degradation is apparent after five years of shelf storage, no basis exists for formulating such a prediction. However, based on this series of tests and the resultant comparative data, it is reasonable to conclude that the cameras will perform within specification during the next two years with a high probability of equal performance during the next four years.

SPECIFICATION NUMBER

T-854152

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Westinghouse Electric Corporation

AEROSPACE DIVISION  BALTIMORE, MD., U.S.A.

TITLE

TEST PROCEDURE FOR SHELF LIFE EVALUATION
OF APOLLO B&W TV CAMERAS

PAGE 1 OF 12 PAGES

SPECIFICATION TYPE

CODE IDENT. NO.

97942

SPECIFICATION NUMBER

T-856752

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1.0 PURPOSE

The purpose of this test is to determine the condition of Apollo Block and White television cameras after a period of extended shelf storage.

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2.0 SCOPE

Measurements will be made of the following performance characteristics for each camera:

Signal-to-Noise Ratio

Resolution

Observation and/or a photographic record will be made of the following camera characteristics:

Blemishes

Linearity

Shading

Extraneous Noise

Microphonics

Condition of Potting Materials in the Camera

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3.0 GENERAL CONDITIONS

3.1 Test Specimen

The items to be tested are Westinghouse black and white lunar surface television cameras 607R962.

3.2 Tolerance for Measurements

Voltage $\pm 3\%$

Light Level $\pm 10\%$

3.3 Test Data Records

Test data shall be recorded in a standard Westinghouse Test Record Book (form 2509E) and in the test data sheets of this specification. All photographs taken during the tests shall become a part of the test record.

3.4 Participation Required

The tests described herein are for the purpose of establishing the present condition of the black and white television camera to enable analysis of the affects of shelf storage on camera performance. All test data will be collected and attested to by the cognizant engineer. Witnessing of this test by representatives of WEC quality assurance or the government is not required.

3.5 Test Equipment

Calibrated Light Source (NAS 9-3548)

Composite TV Test Set 970B726 (NAS 9-3548)

3.6 Security Classification

The Apollo black and white television cameras are unclassified.

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4.0 TEST PROCEDURE

4.1 Signal-To-Noise As A Function Of Light Level

(Ref. data sheet 5.1)

Signal-to-black-noise measurements will be made in the 10 frame per second mode with the Epc fixed at 8 KV. The signal to noise measurement will be made using one horizontal line and a quarter area pattern. Measurement will be made at approximate light levels of 5×10^{-4} FC, 10^{-3} FC, 5×10^{-5} FC and 10^{-2} FC. Record the results in data sheet paragraph 5.1.

4.2 Resolution as a Function of Light Level

(Ref. data sheet 5.2)

Resolution measurements will be made in both the 10 fps and .625 fps modes. The Epc voltage will be fixed at 8 KV. Using an ElA RETMA pattern, measure limiting resolution and shades of gray varying the light level from approximately 10^{-4} to 10^{-2} FC for the 10 fps mode and 10^{-6} to 10^{-4} FC for the .625 fps mode with at least one step per decade. At each step, the limiting resolution and gray shades will be recorded in the data sheet paragraph 5.2.

4.3 Blemishes

(Ref. data sheet 5.3)

With the Epc voltage fixed at 8 KV and in the 10 fps mode with no light input, observe and photograph the monitor presentation for spots or blemishes. Record comments in data sheet 5.3.

Increase the light input to approximately 10^{-2} FC and observe and photograph the monitor presentation for spots or blemishes. Record comments in data sheet 5.3.

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4.4 Linearity

(Ref. data sheet 5.4)

In the 10 fps mode using a ball chart and crosshatch generator, observe and photograph the monitor presentation.

Record comments in data sheet 5.4.

4.5 Shading

(Ref. data sheet 5.5)

In the 10 fps mode with the Epc voltage fixed at 8 KV, view a white scene of approximately 10^{-2} FC and observe and photograph the monitor presentation for shading. Record comments in data sheet 5.5.

4.6 Extraneous Noise

(Ref. data sheet 5.6)

Vary the light input to the camera (with Epc loop closed) between approximately 0 FC and 10^{-2} FC and observe the monitor presentation for extraneous noise. Record comments in data sheet paragraph 5.6.

4.7 Microphonics

(Ref. data sheet 5.7)

With no light input, subject the camera to light impacts by tapping with one finger along the axis of the tube on the front of the camera.

Observe the level and decay time of any resulting microphonics and record the results in data sheet 5.7.

4.8 Potting

(Ref. data sheet 5.8)

With the camera cover removed, visually inspect all accessible potted areas for indications of cracking, loosening, or other deterioration. Record comments in data sheet paragraph 5.8.

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5.0 TEST DATA

Date _____

Camera Serial No. _____

5.1 S/N as a Function of Light Level

(ref. para. 4.1)

<u>Approximate Light Level</u>	<u>Measured Light Level</u>	<u>Signal Pk-Pk</u>	<u>Noise Blk Pk-Pk</u>	<u>S/N Blk</u>
5×10^{-4} FC	_____	_____	_____	_____
10^{-3} FC	_____	_____	_____	_____
5×10^{-3} FC	_____	_____	_____	_____
10^{-2} FC	_____	_____	_____	_____

5.2 Resolution as a Function of Light Level

(ref. para. 4.2)

Camera in .625 fps mode

<u>Approximate Light Level</u>	<u>Limiting Resolution</u>	<u>Shades of Gray</u>
5×10^{-4} FC	_____	_____
2×10^{-4} FC	_____	_____
5×10^{-5} FC	_____	_____
1×10^{-5} FC	_____	_____

Camera in 10 fps mode

<u>Approximate Light Level</u>	<u>Limiting Resolution</u>	<u>Shades of Gray</u>
5×10^{-3} FC	_____	_____
5×10^{-4} FC	_____	_____
5×10^{-5} FC	_____	_____
2×10^{-5} FC	_____	_____

5.3 Blemishes

(ref. para. 4.3)

No illumination:

Photograph

 (check)

Comments

Illumination 10^{-2} FC

Photograph

 (check)

Comments

5.4 Linearity

(ref. para. 4.4)

Photograph

 (check)

Comments

5.5 Shading

(ref. para. 4.5)

Photograph

 (check)

Comments

5.6 Extraneous Noise

(ref. para. 4.6)

Comments

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5.7 Microphonics

(ref. para. 4.7)

Comments

5.8 Potting

(ref. para. 4.8)

Comments

Date test complete

Responsible engineer

Reference Test Record Book Pages

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